discovery of new double stars and the revision of an extensive list of known ones which appeared most deserving of attention. He remarks: "My work has been wholly a labour of love. During the business hours of every day I have been otherwise fully occupied, and hence my observations have been prosecuted often at the expense of rest, sleep, and recreation. I submit the results to the Royal Astronomical Society as the first contribution of the great equatorial of the Dearborn Observatory." Mr. Burnham had however published, between 1873 and 1877, *nine* smaller lists of new double stars, containing 482 in all; the present catalogue brings up the number to 733; indeed, his energy and success have been alike extraordinary.

In looking over this tenth catalogue of new doubles, many objects are noted which deserve more or less attention. η Piscium, a star of the fourth magnitude, has a companion of the eleventh at a distance of one second, and "there is no known pair among stars of this magnitude or brighter, with so close and minute a companion." Three stars have been found near the celebrated variable, *Algol*, all three closer than Schröter's companion; one of 12·5m. is distant only 10″·6 on an angle of 115°. There are also three new doubles amongst the Pleiades, and a much nearer companion to *Aldebaran* than that observed by Herschel and Struve. In an object in R.A. (1880·0), 21h. 1m. 25s., and Decl. +43° 12′, Mr. Burnham finds the most minute close pair known and terms it "a curiosity in double stars, if for no other reason;" it is too small for Argelander's *Durchmusterung;* the components are about equal and near 11m., distance 0″·4. There are two faint companions to Herschel's "Garnet-star" in Cepheus, and not the least interesting addition is a *comes* of 12·5m. preceding nearly on the parallel, by 0″·7, the star 85 Pegasi, which has large proper motion and a sensible parallax according to the investigations of Prof. Brünnow at Dunsink; as Mr. Burnham remarks the physical connection or otherwise of the faint star should be soon decided.

In the second catalogue, as we have stated above, there are many binary systems, the Chicago observations either confirming previous deductions or indicating new objects in motion. Mr. Burnham doubts the duplicity of *Atlas Pleiadum*, though Struve considered that confidence might be placed in his measures of 1827, an inference somewhat supported by Dr. Hartwig's observation on the occultation of the star by the moon in 1876. An examination of the interior of the trapezium of Orion, afforded not the slightest suspicion of any additional stars, and hence Mr. Burnham concludes that several faint objects supposed to have been seen within it, with smaller telescopes, have no real existence, and he expresses the same opinion as to recent suspected companions of the Pole-star. He shows good reason for inferring that one of the components of Σ 1058 is variable; the brighter star is missing in more than one catalogue where it might be expected to be found, and in 1878 a thorough search did not reveal any double star near its place, but in the early part of the present year he has been more successful and has measured the star on two nights, when the magnitudes were respectively 8 and 11. A reference to Mr. Burnham's notes will afford a number of other objects to which special interest attaches.

OUR BOOK SHELF

The Saidapet Experimental Farm Manual and Guide. By C. Benson. (Madras, 1879)

THIS volume is published by the direction of the Madras Government, and consists of a Report by the Superintendent of the more important results obtained at the experimental farm since its commencement in 1865. An agricultural college has been recently added to the farm establishment, but this educational work lies beyond the scope of the present volume. Of the value of the work done on this experimental farm there can be no question; the Government money spent on it has been well laid out. If the miserable and profitless native systems of agriculture are to be improved, and the land made capable of supporting the rapidly increasing population, it must be by the adoption of the methods here recommended.

In the native agriculture the soil is stirred to the depth of 3 inches only, manure is seldom employed, and grain crops are generally the only ones cultivated; the land is thus reduced to its lowest limit of productiveness. Irrigation is also most wastefully conducted. Eight to twelve feet of water are consumed in the production of a single crop of paddy, the ground being turned into a swamp, and frequently becoming a source of disease to the surrounding population.

The improvements recommended are in the first place a deeper cultivation of the soil, by which its porosity and water-holding power would be increased, and the root development of the crop favoured. An English plough is said to cost twenty-five times the price of a native implement, but the work done is so superior that the increased outlay will be repaid during a single year's cultivation of twenty acres. Many soils also require draining. The rainfall in India is at certain times of the year extremely heavy (16 inches have been recorded at Saidapet in twenty-four hours); on such occasions undrained land becomes for a long period unworkable, and much precious time is lost. Judicious drainage will not diminish the water holding power of heavy land, but rather increase it by promoting the disintegration of the subsoil. Drainage is also greatly needed in many cases for irrigated land; without this the water may become stagnant and its good effect greatly diminished.

The next improvement demanded is the adoption of a proper rotation of crops, in which fodder crops should hold an important place. The experiments have shown that a large number of excellent fodder crops exist, which can be cultivated if need be all the year round. The fodder crops most strongly recommended are cholum (*Sorghum vulgare*), and guinea grass (*Panicum jumentorium*). Sugar cane, where well manured, affords an immense amount of excellent fodder. Paddy may also be often usefully cut while green, and a good supply of fodder thus obtained when the quantity of water available is too small to carry the crop to maturity. Horse gram (*Dolichos uniflorus*) may also be grown with advantage as a fodder crop, and four or five cuttings may be obtained in the year. Being a leguminous plant, rich in nitrogen, it is of great use in bringing poor land into condition, and may be ploughed in as a green manuring with excellent effect.

One great object of the growth of fodder crops is to enable the farmer to raise the condition of his soil by applications of organic manure; to increase the amount of humic matter in the soil is a most important step towards amelioration in such a climate as that of India. The fodder crops should be consumed by cattle, kept, at least during the night, in loose boxes, and the manure thus obtained returned to the land. Other manures recommended are steeped cotton-seed, salpetre, bones, and lime.

Until the condition of the land is raised by proper cultivation and manuring, a large number of improvements must remain impossible. Superior grain crops, and

superior varieties of rice and cotton, can only be grown on good soil; on poor soil they at once deteriorate. The same may be said of live stock: the miserable native breeds are accustomed to starve during a part of every year; such treatment would be fatal to better animals. Until good fodder crops are grown, any permanent improvement in the breeds of farm animals is impracticable.

We might easily extend our notice of this useful volume; it is full of practical information, and must prove of great value to all engaged in agricultural operations in India.

R. W.

Grundriss der chemischen Technologie. Von Dr. Jul. Post. Part ii. (Berlin: Robert Oppenheim, 1879.)

WE have already noticed the first part of Dr. Post's excellent manual of chemical technology (see vol. xvi., 83), which made its appearance towards the end of 1876. Unfortunately, the completion of the work has been delayed by the severe and prolonged illness of the editor. The first portion was mainly confined to a description of the modes of manufacture of crude or intermediate products; the second part treats of the finished or final products. Objections might, doubtless, be raised against such a mode of treatment, but we question if, on the whole, a more systematic method of dealing with so complex a subject as chemical technology could have been devised. The entire work forms unquestionably one of the most, if not *the* most, complete repertorium of the existing processes of industrial chemistry that we know of in any language, and as such we can confidently recommend it to the notice of our chemical manufacturers. Dr. Post has been assisted by an excellent band of collaborators, many of whom are recognised as authorities on the subject of their respective communications. A due amount of space is usually devoted to a consideration of the theory of the various processes when this has been at all worked out; and the description of the mode in which these processes are actually carried into operation is facilitated by numerous diagrams and plans. Dr. Post is to be congratulated on the completion of an exceedingly useful work.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

The November Meteors

THE cloudless sky from the morning of the 12th to the 15th, with the total absence of moonlight, afforded a most favourable opportunity for the observation of the meteors of the Lion. A constant watch was kept up at this observatory from 10 P.M. until daybreak of the 13th, 14th, and 15th, and the results show that the Leonids were considerably in excess of what they had been during the last few years.

The total number of meteors observed was 309, and out of these 104 radiated from the Lions, and 56 clearly indicated five principal radiant points. Four of the radiants were situated near the stars ϵ, γ, δ, and η Leonis, and the fifth was just below (31) Leonis Minoris. The position of this east point was very clearly marked by a stationary meteor of the 1st magnitude. Eighty-six of the meteors were of the 1st or 2nd magnitude, and nine others were brighter than 1st magnitude stars. The largest number of Leonids seen during a single hour was fifteen, from 4 to 5 A.M., on the 14th. S. J. PERRY

Stonyhurst Observatory, November 18

The Platysomid Fishes

I AM very sorry to find that my esteemed friend Prof. H. Alleyne Nicholson has, in the new edition of his "Manual of Palæontology" (vol. ii. p. 138, *note*) committed the mistake of quoting me as his authority for elevating the Platysomid fishes to the "rank of a distinct division of Ganoids." No such proposition occurs in the unpublished paper to which he refers, which was written to follow up the views which I expressed in my account of the structure of the Palæoniscidæ (Palæontographical Society, 1877), as to the abolition of the sub order "Lepidopleuridæ," necessitated by the demonstration of the fact that the Platysomidæ as a *family* are not really allied to the Pycnodontidæ, but are on the other hand so closely linked by ties of structure to the Palæoniscidæ, that, wherever the latter family is placed, thither the Platysomidæ must follow.

My paper on the "Structure and Affinities of the Platysomidæ" was read before the Royal Society of Edinburgh on May 5 of this year, and will in a few weeks appear in the forthcoming fasciculus of that Society's *Transactions*. Prof. Nicholson's mistake as to my views is obviously due to his having only had, and that on one single occasion, a very hurried glance over my proof-sheets. R. H. TRAQUAIR

8, Dean Park Crescent, Edinburgh, November 12

Voice in Fish

THE question as to whether fish have any so-called voice or means of intercommunication having some interest for your readers, I may relate that about six years ago, while engaged in a survey of the Disang iver in Eastern Asam, I had occasion to sound by a line the depth of a pool called the "Deo Dubé" (or deep of the Demon).

While seated in a small *Roh Roy* canoe and very slowly drifting on the pool, I became aware of a number of large Mahsír (*Barbes macrocephalus*) moving about in the water below and around me. Sitting perfectly still I had the pleasure to see them gradually approach the surface and move about me at a foot or so distant, passing alongside, under and round the canoe carefully examining it, bow and stern specially. It may not be easy to guess a fish's *thoughts*, but from the manner in which they examined my symmetrical and grey coloured canoe they appeared to think it might possibly be a huge fish, and dead of course.

While watching their movements I was aware of a peculiar "cluck," or percussive sound—frequently repeated, on all sides, and coming from below, but close to me. Eventually I found that this was made by the Mahsir, and one—passing close along on my right, by itself, made several *distinct* sounds as it went on—that seemed answered by others to the left. If seated, say on the bank, the sound would be loud enough to be heard at 40 feet distance.

A large bivalve also is common in some parts of Eastern Asam that sings loudly in concert. A small *ant* also makes a peculiar thrice-repeated noise by scraping in unison on the dry leaves of its nest if it is disturbed. S. E. PEAL

Silurian Fossils in the "Lower Old Red Sandstone" of the Curlew Mountain District

YOUR correspondent in NATURE, vol. xxi. p. 32, on the above subject has evidently misunderstood the notice (NATURE, vol. xx. p. 641). The rocks in question, though belonging to what is generally known as the "Old Red Sandstone," contain Silurian fossils, which confirms the opinion of myself and others that the lower Old Red should be regarded as the upper part of the Silurian formation. G. HENRY KINAHAN,

President of the Royal Geological Society of Ireland

Dublin, November 17

The Paces of the Horse

A GOOD many ingenious contrivances have lately been invented by which to find out the true movements of the feet of the horse in its various paces, notably that described in "A Study on Locomotion" which appeared in NATURE, vol. xx. pp. 434, 468, 488.

My object in writing this letter is to challenge the assumption of all these experimenters that their diagrams should constrain artists to correct their representations of animals in motion.

When, for instance, Prof. Marey says of his diagrams, "these pictures are correct as regards the position of the members; it would be the artist's duty to add elegance of form," it is apparent to me that such a division of labour would never produce a picture. Take Fig. 16, for instance, representing the true position of the legs in galloping, and I venture to say no amount of